MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

TCI 3371 – COMPUTATIONAL INTELLIGENCE II

(All sections / Groups)

6 October 2015
2:30pm-4:30pm
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question paper consists of **SIX pages**, which includes the front cover, with **FIVE Questions** only.
2. Attempt **FOUR** out of **FIVE** questions. All questions carry equal marks and the distribution of the marks for each question is given.
3. Please print all your answers in the answer booklet provided, and start each question on a new page.

Question 1 [10 marks]

(a) Explain the following terms:
(i) Diploid
(ii) Genotype
(iii) Alleles

[3 marks]

(b) Explain the meaning of the word "***search***" from the following perspectives:
(i) ***search*** for stored data
(ii) ***search*** for paths to goals
(iii) ***search*** for solutions

[3 marks]

(c) Hillis (1990) used diploid chromosomes in an attempt to apply genetic algorithm to evolve sorting networks. Each chromosome consisted of eight 4-bit "codons". Each codon represented an integer between 0 and 15. An example of the integers encoded by a pair of chromosomes (A and B) is given below:

A	1111	0011	0110	1000	0111	1100	0001	1010
B	1011	0101	0110	1000	0111	1100	1001	0111

(i) Demonstrate how the comparisons can be encoded by chromosome pair A and B?
(ii) Explain the terms *homozygous* and *heterozygous*.
(iii) How many *homozygous* and *heterozygous* positions contained in the chromosome pair A and B?
(iv) What is the total number of comparisons?

[4 marks]

Reference:

Hillis, W.D. 1990. Co-evolving parasites improve simulated evolution as an optimization procesure. *Physica D* 42:228-234.

Continued.....

Question 2 [10 marks]

(a) Genetic algorithms have been used to evolve LISP program and cellular automata. Explain these two examples of genetic algorithms in evolving computer programs.

[3 marks]

(b) Given the following mathematical formulas:

(1) $\exp(a) - 2\sqrt{a}$

(2) $\sin(a^2) * \cos(a)$

(i) Translate each of the formulas above into a LISP program.

[1 mark]

(ii) What is the representation of each program in b(i) in form of a parse tree?

[2 marks]

(iii) Illustrate how the two parse trees from b(ii) can produce two new parse trees through a crossover process. You should indicate the location of crossover at each parent tree.

[4 marks]

Continued.....

Question 3 [10 marks]

(a) Apart from genetic algorithm, what are another two common approaches to modeling natural evolution?

[2 marks]

(b) Differentiate the Baldwin hypothesis and the Lamarckian hypothesis.

[4 marks]

(c) Explain the following two terminologies:

(i) The Building Block Hypothesis [2 marks]

(ii) Royal Road Functions [2 marks]

Continued.....

Question 4 [10 marks]

(a) What is meant by this phrase "*the deception of genetic algorithm*"?

[2 marks]

(b) List four features of an idealized genetic algorithm.

[4 marks]

(c) Explain the following terms:

(i) tournament selection [2 marks]

(ii) roulette-wheel selection [2 marks]

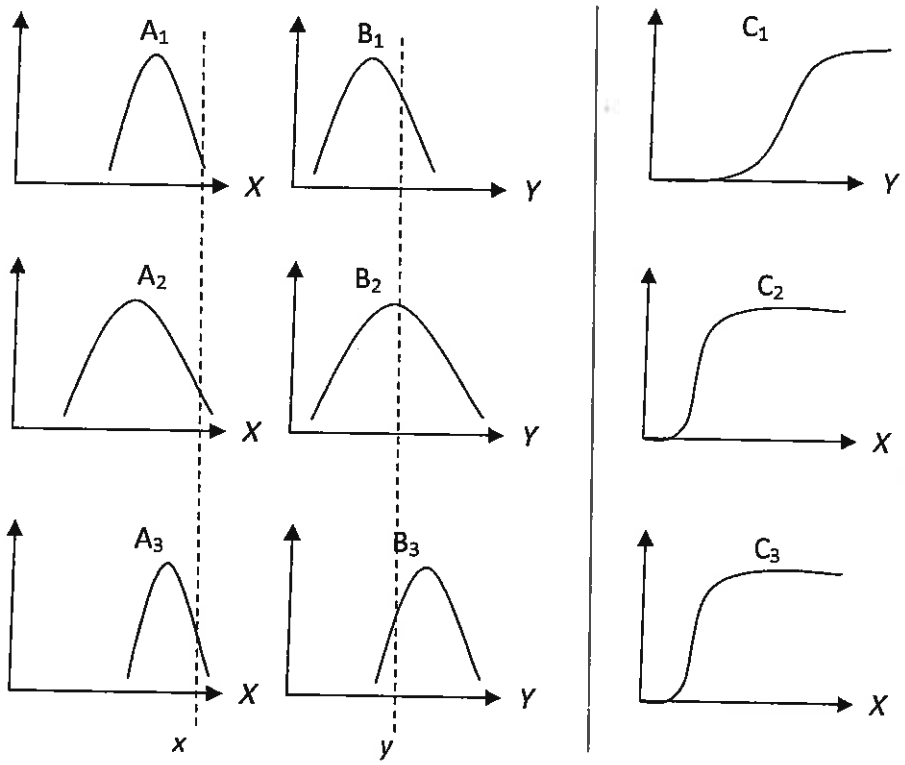
Continued.....

Question 5 [10 marks]

(a) Explain the architecture of an adaptive neuro-fuzzy inference system (ANFIS) for a first-order Sugeno fuzzy model.

[5 marks]

(b) A Tsukamoto fuzzy model is shown below. Explain, by completing the figure below, how defuzification could be done to estimate an outcome given inputs x and y?



[3 marks]

(c) List two advantages of the Sugeno ANFIS as compared to the Mamdani ANFIS.

[2 marks]

End of Paper